Science Standards of Learning

Sample Scope & Sequence

Grade 6

Commonwealth of Virginia
Department of Education
Richmond, Virginia
2003

Virginia Department of Education
P.O. Box 2120
Richmond, Virginia 23218-2120
http://www.doe.virginia.gov

Superintendent of Public Instruction
Jo Lynne DeMary

Deputy Superintendent for Instruction
Patricia I. Wright

Assistant Superintendent for Instruction
Linda M. Wallinger

Office of Elementary Instructional Services
Linda Poorbaugh, Director
Paula J. Klonowski, Science Specialist

Office of Middle and High School Instructional Services
James C. Firebaugh, Director
Eric M. Rhoades, Science Specialist

Preface

As an additional resource to help school divisions develop curricula aligned to the 2003 Standards of Learning, the Virginia Department of Education has developed sample scope and sequence documents for kindergarten through grade eight and for core high school courses. These sample documents provide guidance on how the essential knowledge, skills, and processes that are identified in the Standards of Learning and the Standards of Learning Curriculum Frameworks may be introduced to students in a logical, sequential, and meaningful manner.

These sample scope and sequence documents are intended to serve as general guides to help teachers and curriculum developers align their curricula and instruction to support the Standards of Learning. Each sample document is organized around specific topics to help teachers present information in an organized, articulated manner. Also included are correlations to the Standards of Learning for that curricular area for a particular grade level or course, as well as ideas for classroom assessments and teaching resources.

The sample scope and sequence documents are not intended to prescribe how curriculum should be developed or how instruction should be delivered. Instead, they provide examples showing how teachers and school divisions might present to students in a logical and effective manner information that has been aligned with the Standards of Learning. School divisions that need assistance in developing curricula aligned with the Standards of Learning are encouraged to consider the sample scope and sequence guides. Teachers who use the documents should correlate the content identified in the guides with available instructional resources and develop lesson plans to support instruction.

The *Science Standards of Learning Sample Scope and Sequence* and the *Science Standards of Learning Curriculum Framework* can be found in both PDF and Microsoft Word file formats on the Virginia Department of Education's Web site at http://www.doe.virginia.gov/VDOE/Instruction/sol.html.

Introduction

The following sample scope and sequence is based on the essential content, skills, and processes developed for each Sixth Grade standard in the *Science Standards of Learning Curriculum Framework*. It is not intended to be a complete or exhaustive set of all that students should master at this level, but instead the scope and sequence organizes a core of key skills, content, and processes around basic topic areas.

The topic areas generally correspond to individual standards; however, certain standards are reorganized and grouped with components of other standards to comprise meaningful instructional clusters. The various topics are not intended to require equal instructional time. Additional objectives have not been developed, and no attempt has been made to transition or further explain the content. Additional information may be obtained from the overview and introductory sections of the Sixth Grade *Science Standards of Learning Curriculum Framework* (http://www.doe.virginia.gov/VDOE/Instruction/Science/sciCF.html).

An important and consistent thread among these organizational topics is the application of inquiry skills throughout. Students should have an opportunity to master the various science concepts in each topic area in the context of active learning and inquiry processes. The focus on inquiry is further reinforced by having the first topic in the scope and sequence as a discrete treatment of the science skills; however, a discrete treatment is certainly not required. This represents only one way to organize instruction; there are many other valid and useful organizational schemes.

Effective science teaching requires assessing and understanding what students know and need to learn and then challenging and supporting them to learn it well. The array of effective assessment techniques that teachers can employ in the classroom goes well beyond traditional assessments, and science instruction lends itself well to alternative approaches such as portfolios, student self assessments, and short videotaped presentations. The assessments mentioned in the scope and sequence are intended to be general. It is the role of the local curriculum to develop a detailed review of what is most effective for the particular concept being developed.

The resources section included in this scope and sequence provides a brief sample of instructional resources and staff development materials that are generally available without charge. There is a significant body of commercially available instructional materials that correlates well with the Science Standards of Learning and is of very high quality. This document, however, does not include references to those materials.

Organizing Topic	Related Standard
Investigation Skills and the Nature of Science	**6.1**
Investigating the Solar System	**6.8 a-i, 6.1**
Investigating Atoms, Elements, and Compounds	**6.4 a-g, 6.1**
Investigating Energy	**6.2 a-e, 6.1, 6.9 a,b**
Investigating Solar Energy	**6.3 a-b, 6.1**
Investigating Conservation	**6.9 c,d, 6.1**
Investigating Water	**6.5 a-c, e-f, 6.1**
Investigating the Atmosphere and Weather	**6.3 c-e, 6.5 d, 6.6 a-g, 6.1**
Investigating Watersheds	**6.5 g, 6.7 a-g, 6.9c-d, 6.1**

Organizing Topic	Essential Knowledge, Skills, and Processes	Related SOL	Sample Classroom Assessment Methods	Sample Resources
Investigation Skills and the Nature of Science (A discrete introduction to specific science skills is not necessary, as all of the inquiry skills should be incorporated within the following topical areas. Teachers may consider introducing some of these skills in isolation or coordinated with mathematics, English, and history instruction.)	**Students should be able to:** make observations that can be used to discriminate similar objects and organisms, paying attention to fine detail. develop a classification key that uses numerous characteristics. make precise and consistent measurements and estimations. create approximate scale models to demonstrate an understanding of distance, volume, and quantity. differentiate between independent (manipulated) and dependent (responding) variables in a hypothesis. compare and contrast predictions and inferences. Analyze and judge the evidence, observations, scientific principles, and data used in making predictions and inferences. design an experiment in which one variable is manipulated over many trials. collect, record, analyze, and report data using metric terminology. organize and communicate data using graphs (bar, line, and pie), charts, and diagrams.	6.1 a-k	Student demonstrations Classroom observations Student laboratory reports Quizzes Tests	*Teaching and Learning the Basic Science Skills* videotape teacher training series, site guide: http://www.doe.virginia.gov/VDOE/Instruction/sol.html DOE's *Lessons From the Bay* learning module: http://www.doe.virginia.gov/VDOE/LFB/ VDOE PC and Macintosh Image Processing software and training videotapes SOL assessment blueprints and sample items *Science SOL Curriculum Framework:* http://www.doe.virginia.gov/VDOE/Instruction/Science/sciCF.html

Organizing Topic	Essential Knowledge, Skills, and Processes	Related SOL	Sample Classroom Assessment Methods	Sample Resources
Investigation Skills and the Nature of Science (continued)	design models that explain a sequence. For example, students should be able to describe the sequence of events involved in the process of photosynthesis. propose hypotheses or prediction from observed patterns.	6.1 a-k		

Organizing Topic	Essential Knowledge, Skills, and Processes	Related SOL	Sample Classroom Assessment Methods	Sample Resources
Investigating the Solar System	**Students should be able to:** describe the nine planets and their relative position from the sun. design and interpret a scale model of the solar system (A scale model may be a physical representation of an object or concept. It can also be a mathematical representation that uses factors such as ratios, proportions, and percentages.) explain the role of gravity in the solar system. compare and contrast revolution and rotation and apply these terms to the relative movements of planets (and moons). model and describe how day and night and the phases of the moon occur. model and describe how the Earth's axial tilt causes the seasons. describe the unique characteristics of planet Earth. discuss the relationship between the gravitational pull of the moon and the cycle of tides. compare and contrast the ideas of Ptolemy, Aristotle, Copernicus, and Galileo related to the solar system.	6.8 a-h	Student demonstrations Classroom observations Student laboratory reports Quizzes Tests	*The Earth in Space Teacher Training Module:* http://www.smv.org/pubs/index.html NASA Space Resources electronic publications: http://spacelink.nasa.gov/.index.html NASA Education Homepage: http://education.nasa.gov NASA website: http://www.nasa.gov Lesson plan for scale model of the solar system: http://lyra.colorado.edu/sbo/mary/Scale/solar_systemt.html

Organizing Topic	Essential Knowledge, Skills, and Processes	Related SOL	Sample Classroom Assessment Methods	Sample Resources
Investigating the Solar System (continued)	create and interpret a timeline highlighting the advancements in solar system exploration over the past half century. This should include information on the first modern rockets, artificial satellites, orbital missions, missions to the moon, Mars robotic explorers, and exploration of the outer planets.	6.8 a-h		
	apply 6.1 science skills to the context to the content of this topic.	6.1		

Organizing Topic	Essential Knowledge, Skills, and Processes	Related SOL	Sample Classroom Assessment Methods	Sample Resources
Investigating Atoms, Elements, Molecules, and Compounds	**Students should be able to:**		Student demonstrations Classroom observations Student laboratory reports Quizzes Tests	*Physical Science SOLutions* module: http://www.smv.org/pubs/index.html
	create and interpret a simplified model of the structure of an atom. compare and contrast the atomic structure of two different elements. explain that elements are represented by symbols. identify the name and number of each element present in a simple molecule or compound such as O_2, H_2O, CO_2, or $CaCO_3$. model a simple chemical change with an equation, and account for all atoms. Distinguish the types of elements and number of each element in the chemical equation. (balancing equations will further be developed in Physical Science). name some of the predominant elements found in the atmosphere, the oceans, living matter, and in the Earth's crust.	6.4 a-g		
	apply 6.1 science skills to the content of this topic.	6.1		

Organizing Topic	Essential Knowledge, Skills, and Processes	Related SOL	Sample Classroom Assessment Methods	Sample Resources
Investigating Energy	**Students should be able to:** comprehend and apply basic terminology related to energy sources and transformations. compare and contrast potential and kinetic energy through common examples found in the natural environment. create and interpret a model or diagram of an energy transformation. analyze and describe the transformations of energy involved with the formation and burning of coal and other fossil fuels. compare and contrast renewable and nonrenewable energy sources. design an investigation that demonstrates light energy being transformed into other forms of energy. design an application of the use of solar and wind energy. chart and analyze the energy a person uses during a 24-hour period and determine the sources. compare and contrast energy sources in terms of their origins, how they are utilized, and their availability.	6.2 a-e	Student demonstrations Classroom observations Student laboratory reports Quizzes Tests	Project Learning Tree's *Energy & Society* teaching module: http://www.plt.org DOE's *Lessons From the Bay* learning module: http://www.doe.virginia.gov/VDOE/LFB/ U.S. Dept. of Energy resources for teachers & students: http://www.fe.doe.gov/education/energylessons/ U.S. Dept. of Energy site for background energy information: http://www.eere.energy.gov/

Organizing Topic	Essential Knowledge, Skills, and Processes	Related SOL	Sample Classroom Assessment Methods	Sample Resources
Investigating Energy (continued)	analyze the advantages and disadvantages of using various energy sources. analyze and describe how the United States energy use has changed over time. predict the potential impact of unanticipated energy shortages.	6.2 a-e		Curriculum guides and activities from the National Energy Education Development project: http://www.need.org/ Example of NASA lesson about the Earth's energy budget: http://media.nasaexplores.com/lessons/01-052/5-8_1.pdf Information on energy and classroom materials from the Geothermal Education Office: http://geothermal.marin.org/
	explain the role of water in power generation.	6.5 f		
	differentiate between renewable and nonrenewable resources. analyze how renewable and nonrenewable resources are used and managed within the home, school, and community.	6.9 a,b		

Organizing Topic	Essential Knowledge, Skills, and Processes	Related SOL	Sample Classroom Assessment Methods	Sample Resources
Investigating Solar Energy	**Students should be able to:** comprehend and apply basic terminology related to solar energy including wavelength; ultraviolet, visible, and infrared radiation; and reflection and absorption. analyze and interpret a chart or diagram showing the Earth's energy budget. analyze, model, and explain the Greenhouse Effect in terms of the energy entering and leaving the atmosphere. design an investigation to determine the effect of sunlight on the heating of a surface. analyze and explain how convection currents occur, and how they distribute heat energy in the atmosphere and oceans	6.3 a,b	Student demonstrations Classroom observations Student laboratory reports Quizzes Tests	

Organizing Topic	Essential Knowledge, Skills, and Processes	Related SOL	Sample Classroom Assessment Methods	Sample Resources
Investigating Conservation	**Students should be able to:**			
	describe the role of local and state conservation professionals in managing natural resources. These include wildlife protection; forestry and waste management; and air, water, and soil conservation. analyze resource-use options in everyday activities, and determine how personal choices have costs and benefits related to the generation of waste. analyze reports, media articles, and other narrative materials related to waste management and resource use to determine various perspectives concerning the costs/benefits in real-life situations. evaluate the impact of resource-use, waste management, and pollution prevention in the school and home environment.	6.9 c,d		
	apply 6.1 science skills to the context to the content of this topic.	6.1		

Organizing Topic	Essential Knowledge, Skills, and Processes	Related SOL	Sample Classroom Assessment Methods	Sample Resources
Investigating Water	**Students should be able to:** comprehend and apply key terminology related to water and its properties and uses. model and explain the shape and composition of a water molecule. design an investigation to determine the relative density of liquid and solid water at various temperatures. compare the relative density of liquid and solid water. comprehend the adhesive and cohesive properties of water. design an investigation to determine the effects of heat on the states of water. model and explain why ice is less dense than liquid water. relate the three states of water to the water cycle. design an investigation to demonstrate the ability of water to dissolve materials. design an investigation to determine the presence of water in plant material (e.g., a fruit). infer how the unique properties of water are key to the life processes of organisms.	6.5 a-f	Student demonstrations Classroom observations Student laboratory reports Quizzes Tests	DOE's *Lessons From the Bay* learning module: http://www.doe.virginia.gov/VDOE/LFB/ *Virginia's Water Resources, A Tool for Teachers* educator's guide: http://web.lwc.edu/cleanva/teachersvawatercurriculum.htm *Project WET* activity guide: http://www.deq.state.va.us/education/wetinfo.html *Healthy Water Healthy People* educator's guide: http://www.healthywater.org/ *Conserve Water* educator's guide: https://www.projectwet.org/watercourse/catalog.asp

Organizing Topic	Essential Knowledge, Skills, and Processes	Related SOL	Sample Classroom Assessment Methods	Sample Resources
Investigating Water (continued)	design an investigation to model the action of freezing water on rock material. design an investigation to model the action of acidified water on building material such as concrete, limestone, or marble. chart, record, and describe evidence of chemical weathering in the local environment. explain the role of water in power generation. analyze and explain the difference in average winter temperatures among areas in central and western Virginia and cities and counties along the Chesapeake Bay and Atlantic coast.	6.5 a-f		
	apply 6.1 science skills to the content of this topic.	6.1		

Organizing Topic	Essential Knowledge, Skills, and Processes	Related SOL	Sample Classroom Assessment Methods	Sample Resources
Investigating the Atmosphere and Weather	**Students should be able to:** comprehend and apply basic terminology related to air and the atmosphere. identify the composition and physical characteristics of the atmosphere. analyze and interpret charts and graphs of the atmosphere in terms of temperature and pressure. measure and record air temperature, air pressure, and humidity in using appropriate units of measurement and tools. analyze and explain some of the effects that natural events and human activities may have on weather, atmosphere, and climate. map the movement of cold and warm fronts, and interpret their effects on observable weather conditions. design an investigation to relate temperature, barometric pressure, and humidity to changing weather conditions. interpret basic weather maps, and make forecasts based on the information presented. compare and contrast cloud types, and relate cloud types to weather conditions. compare and contrast types of precipitation.	6.6 a-g	Student demonstrations Classroom observations Student laboratory reports Quizzes Tests	NOAA education site: http://www.education.noaa.gov/ National Weather Service education site: http://www.nws.noaa.gov/om/edures.htm DOE's *Lessons From the Bay* learning module: http://www.doe.virginia.gov/VDOE/LFB/

Organizing Topic	Essential Knowledge, Skills, and Processes	Related SOL	Sample Classroom Assessment Methods	Sample Resources
Investigating the Atmosphere and Weather (continued)	compare and contrast weather-related phenomena including thunderstorms, tornados, hurricanes, and drought. evaluate their own roles in protecting air quality.	6.6 a-g		
	analyze the role of heating and cooling in the formation of clouds. order the sequence of events that takes place in the formation of a cloud.	6.3 c,d,e		
	analyze and explain the difference in average winter temperatures among areas in central and western Virginia and cities and counties along the Chesapeake Bay and Atlantic coast.	6.5 d		
	apply 6.1 science skills to the context to the content of this topic.	6.1		

Organizing Topic	Essential Knowledge, Skills, and Processes	Related SOL	Sample Classroom Assessment Methods	Sample Resources
Investigating Watersheds	**Students should be able to:** comprehend and apply basic terminology related to watersheds. use topographic maps to determine the location and size of Virginia's regional watershed systems. locate their own local watershed and the rivers and streams associated with it. design an investigation to model the effects of stream flow on various slopes. analyze and explain the functioning of wetlands and appraise the value of wetlands to humans. describe an example of a wetland. explain what an estuary is and why it is important to people. propose ways to maintain water quality within a watershed. explain the factors that affect water quality in a watershed and how those factors can affect an ecosystem. forecast potential water-related issues that may become important in the future.	6.7 a-g	Student demonstrations Classroom observations Student laboratory reports Quizzes Tests	DOE's *Lessons From the Bay* learning module: http://www.doe.virginia.gov/VDOE/LFB/ Chesapeake Bay Foundation website: http://www.cbf.org Chesapeake Bay Program website: http://www.chesapeakebay.net/ *Project Wild Aquatic* activity guide: http://www.projectwild.org/materials/materials.htm *Wonders of Wetlands* activity guide: https://www.projectwet.org/watercourse/catalog.asp

Organizing Topic	Essential Knowledge, Skills, and Processes	Related SOL	Sample Classroom Assessment Methods	Sample Resources
Investigating Watersheds (continued)	locate and critique a media article or editorial (print or electronic) concerning water use or water quality. Analyze and evaluate the science concepts involved. argue for and against commercially developing a parcel of land containing a large wetland area. Design and defend a land-use model that minimizes negative impact. measure, record, and analyze a variety of water quality indicators and describe what they mean.	6.7 a-g		*Bay, Plain & Piedmont*, a history of the Chesapeake Bay heartland: http://chesapeakebay.net/pubs/gateways/plainandpiedmont/index.htm
	describe the importance of careful management of water resources.	6.5 g		
	describe the role of local and state conservation professionals in managing natural resources. These include wildlife protection; forestry and waste management; and air, water, and soil conservation. evaluate the impact of resource-use, waste management, and pollution prevention in the school and home environment.	6.9 c,d		
	apply 6.1 science skills to the content of this topic.	6.1		